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ABSTRACT

This issue of the newsletter produced by the Science Department of the British Council contains short reports on activities in Britain in science, in mathematics, and in general. The general section includes descriptions of programmed learning, a curriculum analysis research project, an engineering science development unit, a list of science and mathematics publications as well as abstracts of articles and research studies in science education. A series of short reports on overseas activities concludes the newsletter and provides information on activities in Australia; Bombay, India; and the United States. (PEB)

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Science Education Newsletter

Number 21 April 1973

Issued by

Science Department

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EDITORIAL

With this issue SEN 'comes of age' in the classical sense. Since it first appeared in 1966 we have been encouraged by the enthusiastic response to this news service. SEN is 'news about news' and there are limitations to the quantity of material we can include. British Council headquarters in London and to a certain extent the professional officers overseas maintain a considerable resource collection to back-up the outline data contained in SEN. Readers are invited to pursue their inquiries on matters of interest through local British Council Representatives in the first instance.

In this issue it seemed appropriate to include a survey of the principal British Science and Mathematics curriculum projects that have been initiated since the early 1960s. The range of subject coverage and the sophistication of treatment have varied enormously.

Much progress has been made overseas also and we are pleased to report, in rather greater depth than usual, on a number of new developments in other areas. Three of these reflect the current world wide climate of interest in integrated approaches to science education.

Integrated Science teaching will be the subject of a major International Committee of Scientific Unions (ICSU) Conference in Maryland, USA in April 1973 and SEN 22 will report on this meeting.

SEN No 21

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Select list of Science Projects - 1960 onwards

Project	Level	Date	Director	Headquarters	Publisher	SEN Ref
Nuffield Junior Science	5-13	1964-1967	Mr E R Wastnedge	84 Cleveland Avenue Darlington, Co Durham	Collins	SEN 3.2 5.2
Schools Council 5-13 Science	5-13	1967-1973	Mr L Ennever	School of Education University of Bristol	Macdonald Education	SEN 8.2 19.3
Children Explore their Environment	5-13	1969-1971	Mr J Howard	Bishop Grosseteste College, Lincoln		SEN 12.8a
S/C Progress in Learning Science	8-13	1973-1976	Mrs W Harlen	Reading University School of Education		SEN 21.4
Schools Council Environmental Studies Project 5/13	5-13	1967-1971	Mr M Harris	Cartrifle College of Education	Rupert Hart-Davis	SEN 16.7
Schools Council Project Environment	8-18	1970-1973	R W Colton	Newcastle University Department of Education		SEN 18.23
Schools Council Educational Use of Living Organisms	Whole age range	1969-1972	Dr P Kelly Mr J Wray	Centre for Science Education, Bridges Place London SW6		SEN 15.5
S/C Development of Scientific and Mathematical Concepts	7-11	1968-1973	Dr J Rogers	University College of N Wales, Bangor		SEN 18.15
Scottish Integrated Science Project	Sec school	1969-		Scottish Education Department	Heinemann	SEN 9.6 12.11
Project Highlands and Islands	12-14	1971-	Mr M Roebuck	Department of Education University of Glasgow		SEN 18.17
Nuffield Combined Science	11-13	1965-1969	Mr C Bingham Mr M Elwell	City of Birmingham College of Education	Longmans/ Penguin	SEN 2.3d 12.2

S/C = Schools Council

Nuffield Combined Science Continuation Project	11-15	1972-1973	Mr M J Elwell C D Bingham	City of Birmingham College of Education		SEN 21.5
S/C Project Technology	11-18	1967-1972	Mr G B Harrison	National Centre for School Technology, Trent Polytechnic, Nottingham		SEN 15.7
Nuffield Secondary Science	13-16	1965-1970	Mrs H Misslebrook	Centre for Science Education, Chelsea	Longmans	SEN 8.1 16.4
Nuffield 'O' level Biology, Physics Chemistry	11-16	1962-1967	Prof W H Dowdeswell (Biology) Prof E M Rogers (Physics) Prof H F Halliwell (Chemistry)	University of Bath Nuffield Lodge	Longmans/ Penguin	SEN 6.2
Schools Council Integrated Science Project	13-16	1969-1975	Dr W C Hall Mr B Mowl	Centre for Science Education, Chelsea	Longmans/ Penguin	SEN 14.3 19.1 19.2
Schools Council Measurement of Understanding of Pupils Learning Science	14-16	1966-1969	Prof F W Wagner	Southampton University		SEN 11.4
Schools Council Attitude to Science Scales	14-16	1966-1969	Dr L S Skurnik	National Foundation for Educational Research	NFER	SEN 11.4
Schools Council Evaluation of Science Teaching Methods	14-16	1970-1973	Prof J Kerr	Leicester University		SEN 13.10
Schools Council Reduced Science Courses	16	1969-1972	Prof L R B Elton	Surrey University		SEN 12.8

Nuffield 'A' level Biology, Science, Chemistry, Physics, Physical Science	16-18	1964-1972	Dr P Kelly (Biology) Prof E H Coulson (Chemistry) Dr P J Black & Mr J Ogborn (Physics) Dr J Spice (Physical Science)	Centre for Science Education	Penguin	SEN 9.1 9.2 9.3 9.4 12.1
Nuffield 16+ Science	16-18	1972-	R A Finch D H Fox	IC Ltd, Millbank, London Nottingham College of Education, Clifton Nottingham		SEN 20.2
Scottish Certificate of 6th Year Studies	17-18	1968 onwards		Scottish Education Department		SEN 5.56
Schools Council Engineering Science	16-18	1970-1973	Prof Cantor	Loughborough University		SEN 16.9
S/C Geography 14-18	14-18	1970-1974	Dr Gladys Hickman	Bristol University		SEN 14.8
S/C Geography for the Young School Leaver	14-16	1970-1974	R Beddis T H Dalton	Avery Hill College of Education		SEN 18.2
Nuffield Chemistry Examination and Assessment Project	'A' level	1970-1973	Mr J C Matthews	University of Lancaster		SEN 13.2b
School/University Physics Teaching Pilot Project	'A' level - 1st yr undergrad	1971	Mr R Sutton	University of Cardiff		SEN 15.12 18.14
Nuffield Inter-University Biology Teaching Project	Under-grad	1969-	Prof W H Dowdeswell	University of Bath		SEN 18.10
College Curriculum Science Studies	Science teachers in training	1971-	Mr J K Bird	Southlands College of Education		SEN 20.8

Science Teacher Education Project	Science teachers in training	1969-1974	Dr J Hayson Dr C Sutton	Reading University School of Education, Leicester University School of Education	McGraw-Hill	SEN 13.7 15.4 18.16

2. Aid to Commonwealth Teaching of Science (ACTS)

At the fourth Commonwealth Education Conference, held in Lagos in February 1968, Britain offered to introduce a new Aid to Commonwealth Teaching of Science (ACTS) Scheme, financed initially from Commonwealth Education Conference funds. The Scheme was set up to help developing countries with the reform of Science and Mathematics teaching, and particularly with teacher training and/or curriculum development. The Scheme is operated by the British Council. The British Council, in association with CEDO and ODA, has undertaken the recruitment of ACTS officers and posts created have been filled by British Council officers. By collaboration with CEDO, the British Council has been assisted in the identification of priority bids and in the selection of specialists to fill them. Three major categories of post to be filled were identified as follows:

i. Experts at Science Centres/Curriculum Research and Development Units;

ii. Lecturers, Heads of Departments, or Advisers at Training Colleges or Institutes of Education;

iii. Advisers or Inspectors attached to a Ministry or Department of Education.

The posts have all offered scope in the fields of science and mathematics, for curriculum development, teacher training and advisory work on educational planning and have included work on syllabuses, teaching materials, evaluation and examinations. Since 1969, when the first two ACTS posts were created, the Scheme has grown in size and scope until at present there are 16 ACTS officers working in 13 different Commonwealth countries. It is planned to have a total of 30 ACTS officers at post by the end of the 1973/74 financial year. The accompanying table summarizes the present location and activities of British Council officers appointed to ACTS posts.

SUMMARY OF ACTS OFFICERS' MAIN ACTIVITIES

Country	Post Title	Officer's Name	Major Activities
Botswana	Science Curriculum Development Officer Ministry of Education	Dr C E Fitches (from April 1973)	Consideration and adaptation of Integrated Sciences for Junior Secondary Schools (with reference to Scottish Integrated Science) Liaison with similar Maths/Science Projects in Lesotho and Swaziland. In-service training.
Ghana	Lecturer in Chemistry Methods, Faculty of Education, Univ College of Cape Coast	Mr J L Dobson	Lecturing in Chemistry Methodology to graduates intending to teach up to 'A' level. Moderation and supervision of teaching practice. Evaluation of Science Teacher Education Project. Involvement in syllabus revision. Organisation of refresher courses.
India	Consultant for Primary Science Teaching, Municipal Corporation of Bombay, Primary Education Department	Mr J H Brookes	Development of primary science course, writing of teachers' guides and pupils' books. Evaluation and rewriting of materials. Running of in-service courses for primary teachers.

Kenya	Lecturer in Chemistry Methods, Faculty of Education, Univ of Nairobi	Mr M A Atherton	Lecturing in Science Teaching and Chemistry Methodology. Lecturing in Chemistry at Dept of Chemistry. Involvement in BEd course and Secondary School Science Project (Chemistry Panel).
Lesotho	Science/Mathematics Advisory Officer, Science/Mathematics Centre, Ministry of Education	Mr P J Towse (from April 1973)	Initiating Science Curriculum Development at primary level. Development and implementation of Junior Secondary Science course (based on Scottish Integrated Science) General Advisory Mathematics and Science Service and In-service Training.
Malawi	Science Adviser, Ministry of Education	Mr R A Hargreaves (from April 1973)	Inspector of Science for Primary and Secondary levels. In-service courses for Secondary Science Teachers. Involvement in examinations and evaluation.
Malaysia	Adviser, Ministry of Education (Physics)	Mr L Beckett	Development and evaluation of General Science course and production of teaching materials. In-service courses, based on Nuffield Physics course. Involvement in examination syndicate.
Malaysia	Adviser, Ministry of Education (Mathematics)	Mr E D Bicknell	Assistance with introduction of Secondary level Modern Mathematics in years 4 and 5. Assisting at In-service courses. Textbook adaptations. Involvement in ETV.
Malta	Adviser on Science Teaching, Ministry of Education	Dr D R N Custance (from August 1973)	Implementation of New Science course (based on Scottish Integrated Science). Organisation and running of In-service courses for science teachers. Liaison with University and Training Colleges in teaching of Science. Assisting with teaching at Training College level.
Nigeria	Science Adviser, Institute of Education, Ahmadu Bello University, Zaria	Mr B L Young	Development of Primary Science course. Evaluation and production of teaching materials. In-service courses; involvement in examinations and equipment production.
Nigeria	Lecturer in Education (General Science Methodology), Adeyemi College of Education, Univ of Ife	Mr P A Whittle (from April 1973)	Lecturing with special reference to Methods and Curriculum in General Science, supervision of teaching practice. In-service training for Secondary school teachers.

Sierra Leone	Curriculum Revision Officer, Institute of Education, Univ of Sierra Leone	Mr D R Hill	Development of secondary "Core Course Integrated Science" and organisation and running of writing workshops to produce draft units for evaluation in trial schools. In-service training courses, visits to schools for orientation and evaluation.
Sri Lanka	Mathematics Adviser, Curriculum Development Centre, Ministry of Education, Colombo	Mr J D Trickett	Production of teaching materials, In-service training and evaluation of the Mathematics schemes, at Secondary level.
Swaziland	Head of Science Department, William Pitcher Teacher Training College, Manzini	Mr D Slimming	Organisation and administration of Science Department in the training of Primary and Junior Secondary school teachers. Coordination of the Swaziland Integrated Science Project (based on the West Indies Integrated Science Project), including production of materials, evaluation and In-service courses.
Zambia	Head of Science, Curriculum Development Centre, Lusaka	Mr P M H Davies	Organisation and development of Primary and Secondary Science education, with special reference to Environment Science at Primary level.
Zambia	Lecturer in Mathematics, Institute of Education, Univ of Zambia	Mr G P Thompson	Organisation of training of Primary teachers for posts in Primary Teacher Training Colleges. Running In-service courses (Primary), supervision of teaching practice. Assisting at CDC.

3. Association for Science Education: Report on the Association's Annual Meeting

The Annual Meeting of the Association for Science Education was held at the University of Birmingham, from 2 January to 5 January 1973. Approximately 800 people were resident at the Conference and between 300 and 400 day visitors attended. Of the participants, about 70 were from overseas and represented some 20 different countries. The British Council Science Education Section and CEDO Curriculum Division jointly organised exhibitions of basic improvised science equipment, with special reference to teaching science overseas, and of approaches to Integrated Science Teaching. In addition, a wide variety of overseas science teaching materials and science teachers' journals were on display.

The first Overseas lecture session was chaired by Mr D G Chisman, Deputy Director of the Curriculum Division of CEDO. Dr David Lockard, Director of the International Science Teaching Centre of the University of Maryland, USA, gave an illustrated lecture on Economical Science Teaching Equipment, which was followed

by a lively discussion especially among overseas participants.

The second Overseas lecture was chaired by Dr G Howell, Head of Science Education Section of the British Council. Professor P Strevens, Professor of Applied Linguistics, University of Essex, gave a talk on Language Problems for the Learner of Science, with special reference to the Overseas situation, which again led to a discussion of individual problems from the audience.

Apart from the special overseas sessions, all overseas visitors participated fully in the general programme. In addition to lectures such as "Nuffield 'A' level Physics" and "Chemical Education in the post-Nuffield Era", which were of direct relevance to the teaching situation, there was ample opportunity for science teachers to keep abreast with recent developments and research in various fields of science from "Certain Aspects of Medical Physics" to "Microbes in the Service of the Community".

Complementing the formal programme was an extensive exhibition of books and apparatus mounted by various publishers and school equipment manufacturers.

4. Schools Council Project - Progress in Learning Science

This is a new project which will start in April 1973 under the direction of Mrs Wynne Harlen at the School of Education, University of Reading. Matching children's science activities to the level of each individual's intellectual development has been recognised as important by the Science 5-13 Project amongst others. The experience of the 5-13 project has also revealed that teachers need help in diagnosing their children's levels of development in various scientific areas and concepts. The purpose of this further project is to develop materials to assist teachers with this part of their work. When the project starts in April 1973 it aims to produce:

4.1 Check lists of statements to help teachers to structure and record their observations of children's overt behaviour which has a validated relationship with individual development.

4.2 A guide to assist teachers in making use of the observations by indicating which kinds of scientific activities are appropriate at different developmental stages.

4.3 A handbook giving an account of the production and validation of the check lists so that the teachers can produce schemes of assessment matching their own particular way of working should they prefer to do so rather than use the materials produced by the project.

The work will start with a series of discussions with teachers to define different problems encountered in identifying stages of individual development and matching science activities to them. At the same time there will be a set of literature available on the assessment of individual children and a study of the work of those projects most relevant to this work, such as the Formation of Scientific Concepts (see SEN 18.15) and Nuffield Mathematics Development of Individual Assessment Tests (see SEN 11.4k). Following this, those approaches indicated as likely to be most fruitful will be developed. Drafts of observation lists, check lists thought to be suited to the different setting in which children's learning of science is organised will be tried out in small scale pilot trials. These will then be revised and given further trials over a much wider geographical area on a representative sample of schools. Evaluation of these large scale trials will provide more reliable information for refining and revising the draft materials. For further information from April 1973 write to the Project Director, School of Education, University of Reading, Reading, Berkshire.

5. Nuffield Combined Science in Middle Schools Continuation Project

The combined science material was originally developed to meet the needs of children in the early years of secondary education (see SEN 2.3d). However, since its appearance it has been used a great deal with children in the middle schools that have been becoming increasingly popular in this country. In consequence, an investigation was mounted by the Nuffield Foundation in an attempt to learn more of the problems which might have been encountered in using this material in this setting and also the possibility of offering assistance in their solutions. The joint organisers of the Nuffield Combined Science Project Mr C D Bingham and Mr M Elwell were invited to carry out this enquiry starting in September 1971. A report of their findings is published in the January edition of the ASE Bulletin Education in Science. The report is made under the following headings: Introduction, Scope of the Investigation, Findings, under the headings, 1. School Buildings, 2. Staffing, 3. Daily Pattern of Working, 4. Storage, 5. Laboratory Facilities, 6. Equipment, 7. The Role of the Science Specialist. Copies of Education in Science can be obtained from the ASE, College Lane, Hatfield, Hertfordshire, price 25p not including postage.

6. Combined Science - A double 'O' level subject

This is the title of a paper written in the January edition of the ASE Bulletin Education in Science. The article is written by Mr John B Cook of Haileybury School. In his article Mr Cook explains that the school where he teaches is developing the combined science course with the main purpose of reducing specialisation. This makes it possible for all pupils to study physics, chemistry and biology in reasonable depth to the end of their 'O' level year and then gain fair credit by a double 'O' level pass. The Oxford and Cambridge Schools Examination Board agreed to examine the combined science under their regulations which allow schools to submit alternative syllabuses. The papers are composed from questions submitted by schools entering candidates and then revised by the Board to ensure that the papers are of 'O' level standard. The decisions on the pass mark for combined science are made by the Board's 'O' level awarders. In his article Mr Cook explains in detail the way in which their course is organised and the thinking behind it.

7. Physics Interface Project (See SEN 15.12 and 18.14)

During 1971 the Nuffield Foundation financed a one year pilot study to identify and propose solutions to the problems of matching the wide range in background and ability of sixth-formers to the needs of university first year physics courses. The grant was renewed for a further year from January 1972 to enable the work begun in the first year to be completed. On the basis of the pilot study the Foundation has now made a grant extending over a period of five years from January 1973 to the same group of Physics Departments involved in the pilot scheme, namely those at Birmingham, Cardiff, Chelsea, Keele, Surrey and York. The scheme of work includes:

a. the development of diagnostic procedures to determine the needs of students;

b. the design and construction of self-teaching units of various kinds to help students over the school/university transfer;

c. studies of methods of testing and evaluating the effectiveness of the units developed.

Overall guidance of the project is the responsibility of the Executive Committee, chaired by Professor C A Taylor of Cardiff and consisting of Professor

E J Burge of Chelsea, Professor S J Eggleston of Keele, Professor O S Heavens of York and Professor K W Keohane of Chelsea. The Executive Committee is advised by a larger Coordinating Committee consisting of representatives of both physics and education departments of institutions involved. Full-time coordination of the project is the responsibility of Mr R A Sutton who is based in the Department of Physics at University College Cardiff from whom further information can be obtained. There will be full liaison with the parallel Higher Education Learning Project (HELP) in physics which involves some of the same institutions and has reciprocal Executive and Coordinating Committee membership.

8. Microbiology in Schools Advisory Committee (MISAC)

The Microbiology in Schools Advisory Committee was set up in July 1969 following a symposium entitled Teaching Microbiology in Schools. The aim of MISAC is to promote the teaching of Microbiology in Schools. The study of Microbiology in Schools is an important area because the applications of microbes are so numerous and because microbes provide useful experimental material. It is difficult to assess the present microbiological content of school biology although the influence of Nuffield biology has increased the use of microbial experiments. Microbiological techniques often present problems so that the first product of MISAC might be a survey of practical manuals of use to school teachers. The aims of the Committee are as follows:

8.1 To publicise the relevance of microbiology in school biology to all levels.

8.2 To survey the present microbiology content of school biology.

8.3 To promote the safe use of microbes in schools by advising on precautions relating to the inherent dangers in current techniques and reviewing the microbes used for teaching purposes.

8.4 To enquire into the difficulties experienced by schools attempting practical microbiology.

8.5 To explore methods of information schools of 1. the relevance of microbiology to modern society and 2. careers in microbiology.

8.6 To explore methods of training teachers and technicians in practical microbiology.

8.7 To press for the improvement of technical assistance and equipment for microbiological practical work in schools.

8.8 To encourage the redistribution to schools of unwanted apparatus and equipment.

Further information about MISAC is found in an article written by the Secretary, Dr P W Bainbridge, Department of Microbiology, Queen Elizabeth College, London W8, in the Journal of Biological Education 1972 No 6.

9. The Secondment of Chemists and Chemical Engineers from Industry for Teacher Training

A one day conference organised by the Institution of Chemical Engineers was held at the Royal Society on January 16 1973, under the Chairmanship of Lord Kearton. The main purposes of the Conference were:

9.1 To provide an opportunity for an exchange of views on the contribution

which chemists transferring from industry could make to teaching in school.

9.2 To discuss the possibility of establishing short courses, of duration about 3-4 weeks, for chemists and chemical engineers employed in industry, which would give them an appreciation of modern teaching methods and materials, and of conditions of service in schools.

The conference was attended by principal employers of graduates in the chemical industry, local education authorities, teacher organisations, individual teachers and lecturers in departments and colleges of education.

The Chairman pointed out that the chemical industry was going through a period of contraction resulting in the fact that there was an excessive number of chemists and chemical engineers available to industry. The conference examined what measures had been taken to offer chemists and chemical engineers in industry an insight into the possibilities of redeployment in secondary education.

A 4-week course which was run in 1972 at York University (Department of Education) for 14 employees of ICI in response to enquiries made in 1970 and 1971, was described in detail. Although the course was run at York, many Departments of Education showed an interest in this project. The York course was constructed as follows:

Week 1: Orientation in modern materials and methodology
Week 2: Attachment to schools
Week 3: Teaching practice
Week 4: Discussion of problems, case studies, conditions of service

As a result of the course, 10 of the 14 graduates decided to enter the teaching profession and 9 have been placed.

A general discussion highlighted the problem of professional training. It was generally felt that DES should look into the possibility of organising alternatives to the one-year professional training course open to those who decided it was in their interest to spend time being professionally trained. Few mature men could afford the time or expense for such a full-time training.

The ILEA's course at Furzedown College, where induction courses have been run for people from industry was described. The course consists of 4 six-week sessions, two of which are spent in teaching practice. But it was emphasised that this course did not confer professional status.

There seemed to be a general feeling that there was no longer a shortage of teachers of biology and chemistry. The gaps were in physics and mathematics. It was agreed that it was not solely redundant chemists that were being considered and people should have the right to change jobs when they wanted to. It was agreed that teachers coming from industry would make the profession less in-bred and might help to instil an understanding of industry in children.

A working group was set up to look into the problem, consisting of representatives from industry, colleges and departments of education, DES, local authorities and the Chemical Society, under the Chairmanship of Professor Richardson of University College Swansea.

10. Reading University - MSc in Chemical Education

One of the most recent developments in the pattern of establishment of courses for high degrees in education is the new Masters Degree in Chemical

Education at the University of Reading. This course is coordinated by Mr M Hankinson and Dr M Hudson in the School of Education and Department of Chemistry respectively. This new degree aims to provide teachers with the necessary education, training and opportunity to become better teachers, to improve their knowledge of education, chemical education and chemistry, to introduce them to new problems and techniques involved in research in the three sections and to enable them to prepare new material and aids for their return to teaching. The course will, at least initially, be a full-time course commencing in October 1973 and lasting for one year. A student entering this course would be expected to be a graduate with at least 5 years' full-time teaching in chemistry. There will be three component areas which will be integrated as closely as possible. These would be chemistry, education and chemical education. Component 1 will be covered by the Chemistry Department; Component 2 by the Education Department and Component 3 will be the joint responsibility of the two Departments. Assessment of the course will be based upon one written paper in chemistry and education respectively, together with a dissertation in chemistry and a dissertation in education, and continuous assessment of practical work. It is possible that project work may also be included. Further details can be obtained from the University of Reading, Department of Chemistry, Whiteknights Park, Reading, England.

Mathematics Projects - 1960 onwards

Project	Level	Date	Director	Headquarters	Publisher	SEN Ref
Nuffield Mathematics: Development of Individual Assessment Tests	Primary 5-13	1966-1970	Dr L Pauli	Institut des Sciences de l'Education, Palais Wilson, Geneva	Chambers & Murray	SEN 11.4k
Primary School Mathematics: Evaluation Studies	Primary 5-11	1972-1973	Prof J Wrigley	School of Education University of Reading		SEN 21.13
Nuffield Mathematics Teaching Project	Primary 5-13	1964-1971	Prof G Matthews	Centre for Science Education, Nuffield Foundation, Nuffield Lodge Regents Park, London NW1	Chambers & Murray	SEN 11.3 19.10
The Fife Mathematics Project	9-13	1969-1973	Mr G Giles	Education Department University of Stirling		SEN 20.13
Royal Liberty School Computer Project	11-19	1963-1973	N R Broderick	Hare Hall, Romford, Essex		SEN 21.14
Manchester Mathematics Group	'O' level	1962-1970		School of Education Manchester University	Rupert Hart-Davis	SEN 14.15 15.19i
Contemporary School Mathematics	'O' level	1960-1968	Prof G Matthews	St Dunstans School	Arnold Ltd	
Westminster Mathematics Project	'O' level	1967-1970	Mr B Rayner	Westminster School	Ginn	SEN 12.22h
Midlands Mathematics Experiment	Sec 11-18	1961-1971	C Hope	Worcester College of Education, Henwick Grove Worcester	Harrap	SEN 14.17
Mathematics for the Majority Continuation Project	Sec 13-16	1971-1974	Mr P Kaner	3 The Cloisters, Cathedral Close, Exeter EX1 1HS		SEN 17.9

Mathematics for the Majority (Schools Council)	Sec 13-16	1967-1972	Mr P Kaner	Institute of Education University of Exeter	Chatto & Windus	SEN 14.4 18.20 19.9
Psychology and Mathematics Project	12-16 'O' level	1962-1970	Dr R Kemp	Child Study Unit, Department of Psychology Manchester University	University of London Press	SEN 2.6d
Shropshire Mathematics Experiment	11-16	1964-1971	R S Heritage	37 Heath End Road Alsager, Stoke-on-Trent	Penguin Education	SEN 13.12
Scottish Mathematics Group	12-18	1963-1969		Scottish Education Department	Blackie & Chambers	SEN 18.19
School Mathematics Project	Sec 11-18 Middle 9-13	1961- ongoing	Dr B Thwaites	Westfield College Kidderpore Gardens London NW3	Cambridge University Press	SEN 6.3 12.10 18.18
Swansea Scheme	'A' level	1963-1968		Department of Pure Mathematics, University College of Swansea	Cambridge University Press	SEN 2.6e
Mathematics in Education and Industry	'A' level	1963-	S L Parsonson	57 High Street, Harrow-on-the-Hill, Middlesex	Oliver & Boyd & Macmillan	SEN 3.20 14.16
Continuing Mathematics Project	16-18	1971-1975	A W Fuller	Educational Dev Building University of Sussex		SEN 17.9
Schools Council 6th Form Mathematics Curriculum Project	16-18	1969-1975	Mr C P Ormell	School of Education University of Reading		SEN 15.8
Schools Council - The Mathematics Curriculum - a critical view	11-16	1973-1976	Prof J V Armitage	Shell Centre for Education, University of Nottingham		SEN 21.12

12. Schools Council Project - The Mathematics Curriculum: A critical view

Area of Inquiry The mathematics teacher today faces a daunting array of syllabuses, modern literature, teaching materials, methods and mathematical treatments from which he must choose for his pupils. Whilst the final choice belongs properly to the teacher, the range of choice is so great that he often, of necessity, tends to adopt some simplifying device such as opting for a 'traditional' or 'modern' syllabus, or committing himself wholly to one of the available 'packages'. Teachers increasingly feel a need for help in choosing what mathematics to include for different groups of pupils and in deciding what methods to use in handling the chosen topics.

Procedure The project will produce a series of surveys of central mathematical topics. Each survey will give a synoptic view of the topic at school level. It will show how the topic connects up with other branches of mathematics; it will discuss the various ways of introducing the topic, and it will analyse the attendant advantages or disadvantages of each approach from the point of view of mathematical development as well as classroom presentation; and it will explore possible applications.

It is envisaged that each survey will take the form of a booklet of between 75 and 100 pages. Each booklet will contain:

1. a review of possible syllabus contents in the area covered
2. critical appraisals of those contents from the points of view of mathematical background and classroom presentation
3. a survey of current practices in all syllabuses and a range of typical text books
4. consideration of topics and treatments appropriate to different backgrounds and ability levels
5. a look at problems, as significant riders illuminating the material or as sources of discovery work
6. suggestions for the teacher on lines of work, arising out of 1 and 5, which he could follow up and develop himself
7. illustrative material: applications inside and outside mathematics, mechanical apparatus, visual aids
8. a bibliography: books and journal references for mathematical background, ideas for classroom presentation and source material for applications.

It is hoped that the following major topics will be covered by the surveys:

i. Numbers
ii. Geometry
iii. Algebra
iv. Combinatorial mathematics and related topics
v. Applications
vi. Calculus (as foreshadowed in pre-sixth form work)
vii. Interdisciplinary activities.

A final booklet will attempt to set in a wide perspective the topics which occupy the foreground in the preceding studies.

The Project starts in April 1973. Further information is available from the project director, Professor J V Armitage, Shell Centre for Mathematical Education, University of Nottingham, Nottingham NG7 2RD. Telephone: Nottingham (0602) 56101 Ext 327, or from the Schools Council Project Information Centre, 160 Great Portland Street, London W1N 6LL.

13. Schools Council Project - Primary School Mathematics: Evaluation Studies

Area of Inquiry In the last twenty years or so there has been considerable change both in the content and style of teaching in primary mathematics. The Mathematics Evaluation Advisory Committee thus recommended to the Schools Council the establishment of a number of exploratory studies of new methods to identify and describe the major approaches in the teaching of mathematics in primary schools.

Procedure A framework for the analysis of content and concepts has been devised, and is being used for a study of published tests and texts, and of schemes of work in mathematics produced by working groups of teachers in some thirty LEAs. This analysis has led to the development of a selection of 40 questions for 10 year-olds, representing a sampling of topic areas and concepts revealed. The results will be analysed in terms of the number of children who can handle the separate topic areas and concepts rather than of a child's total score.

Teachers of the children in the pilot study will be asked to give their opinion of the importance of each question. It is hoped to discover relationships existing between children's success and teachers' opinion of importance. Furthermore, the teachers and head teachers taking part will be asked to complete a questionnaire dealing with general organisation of mathematics teaching and with classroom procedures. Results from this part of the study will also be used in the analysis of children's success on individual questions.

These investigations will suggest which methods would be most useful in a major study of the effects of changes in primary teaching.

Relevant Papers 'The First Six Months'. Available free from the project.

The project director is Professor J Wrigley; Research officer: M Ward, at School of Education, University of Reading, London Road, Reading RG1 5AQ. Telephone: Reading (0734) 85234 Ext 218.

Further information is available from the Schools Council Project Information Centre, 100 Great Portland Street, London W1N 6LL.

14. Royal Liberty School Computer Department (See SEN 6.G3)

At the beginning of October 1972 the Royal Liberty School Computer Department moved into new premises and simultaneously changed its name to the London Borough of Havering Educational Computing Service. Their new address and telephone number will be, The London Borough of Havering Educational Computing Service, Tring Gardens, Harold Hill, Romford RM3 3QX, England, telephone Ingrebourne 49115.

15. Computers in Education (See SEN 17.17)

The current issue of Computer Education No. 12 November 1972, published by the Computer Education Group, contains the report of a Working Party of the British Computer Society's Schools Committee. This is entitled Non-numeric computing at school level. The introduction to this report states:

> "At school level computing enters the curriculum either as a subject in its own right, or as a tool to be used in other subjects, or as a tool within the educational process itself. In all three cases the work may have a high or low mathematical content. This set of case studies is offered in an attempt to show that the way ahead can be rewarding with all three approaches when (but of course not only when) the mathematical content is low. The particular reports that appear here have been chosen because between them they currently

cover a fairly full spectrum of non-numeric computing at school level. There is a considerable overlap between the separate contributions and each study has subsidiary objectives so that none fall entirely into one of the three categories described in the preceding paragraph."

The contents of the report are:

What is non-numeric computing? J W Lewis and W Tagg
Diet - an educational package to support the study of nutrition. D Lawrence
A data file of weather for pupils' use. B J Jackson
Assessment tests and historical games at Hatfield School. V J Mills
Computer appreciation v geography teachers. W T Beveridge
Text analysis. J W Lewis and W Tagg

In the opening article describing non-numeric computing the authors point out that at present computing is in a rapidly developing state and it is becoming evident that some existing views of computers and computing require modification. It is unfortunate for example that computing is often associated with mathematical and scientific applications in which the computer behaves much as a powerful desk calculator. It is equally unsatisfactory for computing to be associated with commercial data processing applications where the computer appears as a sophisticated filing cabinet. In any teaching strategy in which the emphasis is on one particular application area the assumption will be that the type of problems solved and the computing facility used are typical of computing in general and that the computing techniques used in a particular case are applicable and appropriate to all other forms of computing. The computer is an extremely versatile piece of equipment - nonetheless it is just that - another facility available to man to be used as the circumstances require. Hopefully in the future computers and computing will be regarded as something which it may or may not be appropriate to use as some part of some activity. The authors then go on to describe problem solving and computer systems approach to such problems and emphasises the importance of identifying the various steps in the process of problem solving.

Problem identification definition	⟶ Derivation of a number of alternative solutions and the selection of the appropriate one	⟶ Implementation of a solution	⟶ Testing and maintenance of solution

The application of this approach is then illustrated together with a number of other facets of computer work in the subsequent articles. As a footnote to the articles proper a list of other related projects is given. The projects referred to are:

School timetabling by computer, directed by H Clark, Headmaster, Camden Square Secondary School, Seaham, Co Durham
An information retrieval project, Mrs W Stephens, St Alban's Girls' Grammar School
Interactive computer simulation of science experiments in schools, P Dean, Chelsea College
Use of simulation programmes in the Sheffield area, W G Gilchrist, Sheffield Polytechnic.

Of these probably the most interesting for readers of Science Education Newsletter is that concerning the simulation of science experiments in schools. At the Science Education Centre at Chelsea College, University of London, texts and programme tapes are being prepared which are designed to be suitable for use

by sixth form science teachers and pupils even if they have no previous experience of computing. The aim is to assist the understanding of science by providing simulated experiments which can fit into the scheme of learning where no possible real experiment exists. The approach is being tested with 10 trial simulations in several schools to discover a common pattern which is most likely to meet the needs of teachers and pupils. This knowledge will then be applied for other ages of pupils and other disciplines.

16. New Maths Study - NFER

The National Foundation for Educational Research in England and Wales started in July 1972 a feasibility study into tests of attainment in mathematics in schools. The project will last two years and is sponsored by the Department of Education and Science. The purpose is to develop two item banks of some 300 questions, one for testing the mathematical attainment of 11 year-olds and the other for 15 year-olds.

The banks would establish the viability of this approach to testing and enable a national survey of mathematical attainment to be carried out. The project has been established because it is desirable that national surveys of attainment in various areas of the curriculum are carried out systematically, to discover whether standards have improved and if so to what extent. The 'set piece' test has many disadvantages for use in a series of surveys, especially in subjects where there is a continuing modification of content and method. An item bank which is replenished periodically will reflect current teaching developments and yet provide selections of items of known characteristics which can be formed into successive tests of comparable level. Working from explicit statements of objectives a blue-print for the item banks will be laid out. Items will then be written, submitted to trial testing and to item analysis. It is expected that about 1000 items for each age range will be pre-tested to yield approximately 400 items per bank as a starting capital.

17. Schools Council/Reading University Sixth-Form Mathematics Curriculum Project (See SEN 15.8; 17.7)

A further discussion paper DP6/72 has been produced by this Project. It is entitled 'Computer Education and Mathematics' and offers a summary of ideas broached in a lecture entitled 'What is the role of the computer in relation to mathematics in the secondary school' given at Reading University in July 1972 by the Director of the Project, Mr C P Ormell.

ACTIVITIES IN BRITAIN - GENERAL

18. Schools Council Loughborough University of Technology Engineering Science Development Unit (See SEN 16.9).

18.1 This project is now well underway, the material produced by the Unit is intended to help prepare students adequately for higher education or employment in a wide range of subjects and careers. All students using the material should leave school with an understanding of scientific method, an ability to approach practical problem solving rationally and an appreciation of the breadth and significance of the major activities which constitute modern engineering. Such students would then be well equipped for future work not only in science and engineering but also in a wide range of careers outside this limited field. An integrated approach is considered to be essential if maximum student motivation is to be achieved and the stated aim realised. It was therefore decided to make the first priority the production of student texts. These are based upon a consideration of a number of specific engineering situations: the analysis of a particular problem is used to introduce major engineering considerations such as design features, optimisation and the influence of economic and social factors. Simple supporting experimental work is also described.

18.2 The Student Text

The range of scientific concepts is so wide that it was decided to break the text into ten units based upon scientific areas of scientific knowledge, each area is linked to an engineering system throughout the text. The scientific areas and principal engineering systems employed for each are:

1. Dynamics: Safety in vehicle collision situations
2. Structures: Bridge structures in the Trent Valley
3. Tribology: Lubrication and wear in power stations
4. Electricity: Power transmission; the Woodhead Project
5. Heat transfer and fluid flow: Domestic central heating systems
6. Vibrations and waves: Vibrations in structures; acoustics; radar
7. Electrical fields and devices: Hi-Fi devices; loudspeakers; microphones and pick-ups; measuring instruments; induction motors
8. Electronics, systems and analogues: Building simple analogue computers
9. Thermo-dynamics: Production of zinc; alternatives to the internal combustion engine
10. The use of materials: materials and surfaces of important kitchen artefacts.

Trials of the student texts are well advanced and work will shortly be started on the students and teachers guides and the problem books. The revision and final editing of the first sections of the text taking into account feed-back from the trial schools and colleges together with comments from a wide range of advisers will commence in the spring term of 1973. An agreement has been reached with Macmillan Education to publish the material commercially in the spring and autumn of 1974. It is hoped to publish those sections of the material which are widely relevant to the first year A-level courses in April 1974 and the remainder of the material in October of that year. Further information can be obtained from the Department of Education (ESDU), University of Technology, Loughborough.

19. Programmed Learning

Volume 10 Number 1 of Programmed Learning and Educational Technology, the Journal of the Association of Programmed Learning and Educational Technology is devoted to Educational Technology in Teacher Training.

Articles include:

19.1 Educational Technology in Teacher Education and Training - a 3 year Development Project - L A Gilbert. This outlines a project financed by the National Council for Educational Technology for the provision of a central reference and consultancy service allied to production of any required material especially in the fields of reading and mathematics.

19.2 The implementation of Educational Technology at Dundee College of Education - John Clarke. Educational Technology is to be implemented throughout Dundee College of Education on its move to a new site in 1974. The account gives details of the conception of the scheme and the experimental phase. Of particular interest is the account of the development of individual study booths. Variations of booths or carrels are described, all housing audiotape players and some with television monitors, cartridge projectors, video cassette players.

19.3 A Bibliography of Microteaching - W Raymond McAleese and Derick Unwin

The journal is available from APLET, 33 Queen Anne Street, London W1 or publishers Sweet and Maxwell, 11 New Fetter Lane, London EC4.

Apart from the above journal there are various sources of information on the development of programmed learning and its implementation.

19.4 One of the most valuable sources is the "APLET Yearbook of Educational and Instructional Technology" 1972/73, published for the Association for Programmed Learning by Kogan Page Ltd. Price £3.50.

Section 1 Introduction
Section 2 APLET its activities and publications
Section 3 A guide to programmed learning and educational technology
Section 4 The Present State of Programmed Learning and Educational Technology. This includes a list of advisory centres in UK, a list of centres offering courses and a list of overseas contacts.
Section 5 Programmed materials available in the United Kingdom. These are listed under subjects and of particular interest to science and mathematics teachers are the lists on Metrication Retraining, Modern Mathematics and Science.
Section 6 A guide to Audio-Visual Media on the Market.

Other organisations apart from APLET are:
British Association for Commercial and Industrial Education
16 Park Crescent, London W1N 4AP
Programmed Learning Unit, Moray House College of Education
Holyrood Road, Edinburgh EH8 8AQ

20. Curriculum Analysis Research Project

The Volkswagen Foundation in Hanover has, because of its concern with education research in educational needs, granted DM 359,000 to the Centre for Education Technology (Director: Professor Norman Mackenzie) at the University of Sussex for a two-year project which will be carried out in close cooperation with

the Deutsches Institut fur Fernstudien at Tubingen. The aim of the project is to develop techniques which can be used by practising teachers, advisers and members of curriculum development teams to analyse and review curricula. Initially the project will be developing free analysis instruments: a resource analysis instrument for major resources such as curriculum packages and text-books; a curriculum analysis for the analysis of a specific curriculum area in a school in the context of the schools aims, situation, curriculum and organisation; and a proposal analysis instrument for the analysis of any proposed change in a specific curriculum area.

After testing and revision these instruments will be compiled into a manual which will give general guidance for their use and include several examples of sample curriculum analysis. Specific guidance on individual content areas will also be given in a series of appendices. Some training will be needed for intending analysts; but the completed analyses will be in a form that can be understood and used by classroom teachers who have had no special training.

It is hoped that the materials developed by this project will be suitable for use in different educational systems and that they will help to create a common basis of concepts and terminology which can be adopted in several countries. For this reason, trial versions of the materials produced will first be tested in Germany and the United Kingdom, and it is intended that revised editions will be made available in other European languages later. Further particulars can be obtained from the Project Leader, Dr Michael Eraut, Centre for Educational Technology, University of Sussex.

21. PUBLICATIONS

21.1 West African Butterflies and Moths, by John Boorman, published by Longman, 1970, price 60p.

This is a handbook which will be of particular interest and use to teachers, non-specialist readers and amateur collectors of butterflies. The author discusses butterflies and moths in general, their structure, life cycles, differences and methods of collecting them and describes the main common families giving details of about 225 of the most common or interesting species found in West Africa. This is a most valuable addition to the Longman's West African Nature Handbooks. The other titles in this series are:

Small Mammals of West Africa	55p	1960
Birds of the West African Town and Garden	55p	1960
West African Lilies and Orchids	55p	1961
West African Snakes	55p	1961
West African Freshwater Fish	60p	1972
West African Trees	60p	1962

21.2 Plant Physiology, compiled by C J Clegg, published for the Association for Science Education by John Murray, London, price 80p.

This book is the first of the new paperback series which is the successor to the well-known Science Masters books. Each of the Lab Books covers one or two topics only, bringing together the cream of the teaching notes and experimental units that have appeared in the School Science Review during the last 10 or 20 years. It is on these Teaching Notes that the great reputation and world-wide circulation of the SSR are largely based. Science teachers will find these down-to-earth books an invaluable source of ideas. The book on Plant Physiology is divided into sections on Radiobiology, Photosynthesis, Gas analysis and respiratory metabolism, Water relations, Cells, Membrane permeability, ion accumulations and translocation, Growth development and hormones, and Plant enzymes. This book will be followed in April by "Cytology: Genetics and Evolution", price 85p. and "Ecology", price 80p. The series will eventually cover topics in Chemistry and Physics as well.

21.3 Environmental Education, published for the National Association for Environmental Education by Heinemann Education Books, 1972 (see SEN 19.5), 70p.

In this small paperback the National Association for Environmental Education has given detailed information about itself and the purpose for such a National Association. The book contains a series of articles on environmental studies at various levels, ranging from the primary school to the university, eg

i. an article on animals in a primary school;
ii. the importance of an 'A' level syllabus in environmental studies;
iii. an article on environmental studies at the university in which different courses offered in environmental studies are discussed.

21.4 Data and the Chemist, ASLIB, price £3.50 (£2.90 to members).

This is the title of ASLIB Occasional Publication No 10 written by M Slater, A Osborne, A Presanis. Since late 1969 ASLIB Research and

Development Department have been exploring the need in science and technology and quantitative data. Some background studies were published in 1971 giving an overall impression of current problems in this area, a preliminary analysis of data use, and an account of 8 data centres. £3.50 net; £2.90 to members from ASLIB Publications Sales.

21.5 Quantitative Data in Science and Technology, ASLIB, price £1.24 (90p to members).

Earlier work has been followed up by a field survey of 500 chemists to explore their opinions and practice in the provision and use of data. The results of this survey are now reported in ASLIB Occasional Publication No 7. The data needs of chemists are summed up as the result of this questionnaire in the following way. Firstly they are diverse, covering many types of material in many subject fields at all levels and evaluated quality. Secondly, they are highly dependent on documentary sources, particularly those that are wide in coverage, up-to-date and readily acceptable. And thirdly, they are frequent and urgent. These characteristics are of fundamental importance and services that aim to meet data needs must bear these characteristics in mind. The publication contains both a brief summary of the survey and the conclusions to be drawn from it as well as the results of the interview survey in detail and data record analysis. Section E of the report surveys specific publications used as data courses, and the frequency and utilisation of these will be of considerable interest to people involved in this field.

21.6 Discovering Chemistry: Books 1-4, by M A Atherton and J K Lawrence, published by John Murray, price £1.00 for Book 1, £1.25 for Books 2 and 3, and £1.40 for Book 4.

This series for both 'O' and CSE level syllabuses aims to introduce ideas and concepts about chemistry through experiment. The text is clearly written and well presented and is interspersed with useful clear diagrams, cartoons and relevant photographs. There are many references to the social and economic aspects of the subject as well as to the historical background of major discoveries and concepts. Further reading sections and end of chapter questions are used as extensions to the text and for reinforcement purposes.

The 4 books cover all 'O' level needs including Nuffield courses and the first 3 books are suitable for CSE level. Data sheets are provided at the end of Books 2, 3 and 4 and SI units are used throughout. Teachers guides will be supplied eventually for each volume.

21.7 Children using mathematics, a report of the mathematics section of the Association of Teachers in Colleges and Departments of Education, edited by K L Gardner, J A Glenn and A I G Renton, published by Oxford University Press, price 75p.

This book is part of the series of Oxford Studies in Education. The report originates from a working conference held at Homerton College Cambridge in September 1970 organised by the Department of Education and Science and the Mathematics Section of the Association of Teachers in Colleges and Departments of Education. The report is not an account of mathematics, but attempts to discuss aspects of primary teaching in the way that will help those who have to plan the activities of the classroom. The teaching of mathematics is undergoing rapid changes in syllabus and method and the report begins by outlining attitudes, concepts and new problems which face the teacher. Succeeding chapters discuss a child's mathematical

needs and development. The assessment of progress, the evaluation of apparatus, technical vocabulary, and the place of mathematics in every day school activities are also covered.

21.8 The Nuffield Mathematics Project - Book 5 Computation and Structure, published by Chambers and Murray, price 85p.

This guide is the fifth in the computation and structure series but some teachers may prefer to introduce parts of it before tackling the whole of 4. The guide is not meant to be worked through meticulously from start to finish but to be used as a source book for teachers to look at as circumstances require.

21.9 Equipment for Audio-Visual Aids 1972/3, a survey compiled by the Information Department of the National Audio-Visual Aids Centre, and published by the Educational Foundation for Visual Aids.

This wide-ranging survey of audio-visual aids currently on the market, is a useful reference source of equipment, all of which has a place in the classroom situation, to varying degrees, depending largely on the school's budget. The survey covers the areas of projectors (including overhead, cine, slide, strip, micro and loop), epidiascopes, episcopes, tape recorders and accessories, record players and amplifiers, television receivers and video-tape recorders, radios, reprographic equipment and display boards and stands. Each area of equipment is preceded by a brief description followed by manufacturer's catalogue number and standard technical features of each piece of equipment. The survey is accompanied by the December 1972 price list.

21.10 Adaptable Furniture and Services for Education and Science: Paper No 6 August 1972, by A J Branton and S P F J Drake, obtainable from Mr Drake, Department of Education and Science, Elizabeth House, York Road, London SE1.

This pamphlet is the result of a study which originated in the Laboratories Investigation Unit which is sponsored by the Department of Education and Science and the Universities' Grants Committee. The principal objectives of the study were:

i. to allow both the first and subsequent occupants of the laboratory to create layouts based on their own educational principles of organisation;
ii. to allow laboratory users to change the use of spaces and relocate laboratory fittings without having to call in specialist subcontractors;
iii. to enable the designer to delay final decisions on fitting out laboratories until after any changes in the detailed brief during the design and early construction period;
iv. to enable the manufacturer to maximise factory production and eliminate site fitting as far as possible;
v. to design a range of components with an initial cost that is within current accepted standards; also to contribute to savings in total life costs by reducing the costs of subsequent adaptation.

After examining all the background information on laboratory layouts and adaptability, the writers put forward the suggestion that in order to obtain adaptability, provision must be made for movable furniture and relocatable services components. They suggest that the best way to obtain such an adaptable laboratory is to provide:

a. a basic services distribution for electricity, water and gases

using a system of overhead booms, drainage being provided by a permanent grid of floor points;

b. movable supplementary services components - gas and electricity bollards, taps and sinks, and drainage channels;

c. movable storage, display and seating provisions conforming with the appropriate standard for science and educational furniture.

The writers suggest that the overhead services type of laboratory is particularly relevant in developing countries. The use of booms for services means that the building envelope and its furniture contents, which are bulky, can be produced with local skills, resources and labour, and the piped services and electrics, service outlets and sinks can be made in the larger centres where facilities are available. About fifteen schools will be using this type of laboratory in Britain by the end of the year. It is claimed that this type of laboratory costs 15 to 20 per cent less than the more traditional type of laboratory.

22. SCIENCE EDUCATION ABSTRACTS

22.1 Development - Problems of Understanding, Sir Hugh Springer
Science for Development in Guyana, D H Irvine
Chemistry for Prosperity - the work of TTI, G R Ames
India - A Sub-Continent Looks Ahead, Atmaram and T R Seshadri
Chemical Bonds - A collaborative programme, Professor R Shaw
Science Teaching - An African view, R J Syme
A Chemist in China, W G Sewell
China Today, Sir David Martin
The Ox Plough Revolution, T M Reynolds
To Feed to Poor - Science in Pakistan, M I D Chughtai

This series of articles appears in Volume 8, No 12 of Chemistry in Britain, published in December 1972 and it attempts to survey chemical aspects of the use of science in helping the people of developing countries to meet their needs and fulfil their aspirations. The marvels of science and technology are visible to all and their critical importance as factors in national economic development are recognised by all nations, not least by those newly emerging from the traditional into the modern world. As they come to grips with the problems of stimulating economic growth through science and technology, they have become aware of the complexity of the conditions necessary for success. Increasingly they recognise that science and technology can make little contribution without the will to advance economically and without a coordinated development policy; success depends on a balanced combination of scientific and technical knowledge, capital, education and management skills. The series of articles which comprise this special edition of Chemistry in Britain, will be of interest to all those concerned with this particular field whether in the actual field of scientific and economic development or in education.

Chemistry in Britain is published by the Chemical Society on behalf of the Chemical Society and the Royal Institute of Chemistry and may be obtained from Chemical Society Publications Sales Office, Black Horse Road, Letchworth, Herts, SG6 1HN, England, price £10 per annum (post free), single copies priced £1 each.

22.2 An Application of Programmed Instruction to Laboratory Work in a Preliminary Physics Course, T J Powell, University College Cardiff, and S A French, University College of Cape Coast, Ghana.

Programmed Learning and Educational Technology, Volume 9, No 6, November 1972, page 324. The physical sciences have received more than their fair share of attention from researchers in the field of education technology. The new teaching aids and programmed instruction have been applied to both the theoretical and practical side of all the major science subjects, but invariably these applications have concentrated on the communication of knowledge in the form of facts or procedures to the exclusion of the more subjective and attitudinal aspects of science training. This paper describes an experimental approach to the teaching of a practical physics course to the preliminary year students of a Ghanaian university. The whole course has been reoriented so that the practical work is approached in a somewhat unusual way in which the particular emphasis is placed on ideas of accuracy. The student is led to develop an appreciation of the errors which occur in the taking of readings and in the calculation of results from those readings. The development of the course in which extensive use is made of programmed instruction is described and some of the problems involved in the programming of subjective material such as this are discussed. The results of pre- and post-testing are

presented and 'gain' scores are related to 'attitude' scores as well as other achievement measures.

Programmed Learning and Educational Technology is the journal of the Association for Programmed Learning and Educational Technology and is published 6 times a year, annual subscription £5, postage 40p. Single issues cost £1. From the Association for Programmed Learning and Educational Technology, 33 Queen Anne Street, London W1, England.

22.3 Some recent developments in chemistry teaching in schools, E H Coulson OBE, Chemical Society Reviews Vol 1, No 4, 1972, page 495.

In all the pressure of new projects and new materials it is not often that a review of this nature and extent appears in the literature. Professor Coulson has attempted to survey not only the developments in chemistry teaching projects, but, more important, the thinking behind chemical education and its development starting with its roots in the mid-nineteenth century and paying particular attention to the evolution of this in the last 20 years. It discusses the reasons for teaching chemistry in schools and how it should be taught as well as looking at changes in course content. Integration within a chemistry course is discussed as are the problems of assessment in the light of the newer aims and objectives of such courses. This remarkably concise and wide ranging review is a valuable addition to the literature.

Chemical Society Reviews are published by the Chemical Society and subscription to non-members is £8 per annum from the Publications Sales Officer, The Chemical Society, Black Horse Road, Letchworth, Herts, SG6 1HN, England.

22.4 Attitude Assessment in Science Teaching, F A Bollen, School Science Review, Volume 54 Number 187, December 1972, page 217

One of the many changes in science teaching attributable to recent curriculum development is an increased awareness of the importance of pupils' attitudes. At the secondary school level this may perhaps be most obvious in the work of the Nuffield Secondary Science Project and the Schools Council Integrated Science Project. The author asks whether it is really possible to assess people's attitudes fairly and make a quantitative comparison of their changes in attitudes as a result of exposure to particular learning experiences. The article discusses attitude scales, attitude statements about discovery teaching and attempts a statistical treatment of attitude scales. The article proposes a reduced attitudes scale and discusses its validity. Three hypotheses were set up for testing using a null approach. The three hypotheses were:

1. Attitude was not affected by the amount of science teaching received at school.
2. Attitude was not affected by the level of attainment they reached in the school science course.
3. Attitude was not affected by the part which practical investigation played in the school science course.

To these was added subsequently a fourth hypothesis:

4. Attitude was not changed by training given during first year of college.

The results of analysing attitude data in the light of the first three

hypotheses are tested and the author concludes that this proves a valuable way of highlighting some useful results of employing the discovery approach in teacher training amongst other things.

School Science Review is the journal of the Association for Science Education and is published by John Murray in September, December, March and June. Annual subscription £5.50 including postage inland or abroad.

22.5 The Transition from School to University Mathematics, by M L Cornelius, The Mathematical Gazette, Volume LVI No 397, October 1972, page 207.

There is a widely held view that the jump from school to university mathematics is a big one. This article records the results of seeking the views and opinions of students at the start of their mathematical studies at university. A questionnaire was distributed to a total of 224 students at the Universities of Durham, Newcastle and Nottingham, all reading mathematics and who commenced their university careers in October 1971. A considerable similarity was noticed between the results from undergraduates at the three different universities. Both their problems and their backgrounds were essentially the same. The article surveys the results under the headings of School Mathematics, Information from Universities, Books, How much mathematics have they done?, Comments from students. The same students were given a further questionnaire at the end of their first term and the results are further analysed. The author comments that the present evidence suggests that in many cases the sixth form teacher has not made himself aware of the work required for first year honours course nor has the university lecturer familiarised himself with school conditions. In defence of both however, it must be admitted that a fairly large number of students seem reluctant to make the effort required of them and inevitably, however conscientious the teacher or lecturer, success or failure depends very much on the attitude of the students. The range of student comment quoted is most interesting. This problem is one which must face many countries and similar surveys might well prove very illuminating elsewhere.

The Mathematical Gazette is the journal of the Mathematical Association and is published four times a year. The journal is published by G Bell & Sons Ltd and its subscription is £1 per issue to non-members.

OVERSEAS ACTIVITIES

23. AUSTRALIA - The Australian Science Education Project (ASEP)

The Australian Science Education Project (ASEP), the first new educational structure of national proportion initiated in Australia for almost half a century, was funded by the Commonwealth and all six States of Australia to the extent of $1,400,000 over a four and a half year period, from October 1 1969.

Its presence, and purpose, structured as it was to cut across State and system boundaries yet to be linked with them presented exciting possibilities. It had resources to make significant national impact, yet the extent of this impact rests with the decisions of individual teachers, rather than, as so often has happened in the past, with decisions vested in the authority of the traditional systems.

Science

ASEP took the position that science could only be justified in the curriculum for what it could contribute to the development of children, and the Project set out to define what this might be. We decided that science and its methods provide an important and special way of interpreting the environment, and by the very nature of the enterprise, could contribute to the intellectual, social and emotional development of children.

Having decided "why science?", the next step was to organise the content and processes of science so that they would be meaningful and relevant to children. We felt that the majority of junior secondary students do not have an inherent interest in its content per se, nor in the logic of its ideas. Science and its processes are interesting to the child in that they provide novel and unusual experiences which are meaningful when they provide a useful way of making sense of his environment.

We present science as both a set of patterns of knowledge which are created by man and which make up a conceptual framework, and the procedures used to establish these patterns and relationships.

ASEP established a five-point environmental scheme which Project materials were to reflect. Briefly, the scheme relates the child to his environment by having him explore:

1. himself as an individual;
2. himself as a group member;
3. the extensions of his physical and mental self;
4. the technology of his environment;
5. the natural environment.

For example, the Unit "Tuning in with the Senses" guides the student to explore his own sensory apparatus, and come to understand the limits of his senses. "Mice and Men" uses the mouse as a model for man and so increases his understanding of himself as a biological organism, and as a group member. A unit "Signals without Words", explores non-verbal signals operating in society, and so develops some understanding of the way in which groups function. "Soils" is devoted to exploring the natural environment under foot.

The scheme has taken a trend in science education in junior forms to a more satisfying level. Junior secondary syllabuses in Australia in general attempt to integrate the sciences. This has often appeared artificial, with the physical,

chemical, biological, and other components remaining clearly visible in the syllabus content statement. When the emphasis in writing is on exploring the environment, traditional subject barriers do not appear and a unification of the sciences occurs naturally. Rarely are the words physics, chemistry, and so on heard in discussion at ASEP.

Materials

Instead of a tight sequence, or a text, it was decided to develop a series of unit topics which could be used by the teacher and his students as springboards to explore the environment. The units were to be complete in themselves, with very little linkage between them. Such a loose organisation permits teachers to put the units together to make up a course which suits them and their students and to intersperse materials other than those from ASEP between units. Or, on the other hand, a teacher may decide to use only one or two ASEP units in conjunction with some other materials he may wish to use. In addition the unit provides a truly integrated scheme in that the only science included is that relevant to the unit topic.

The Project has produced a pool of 40 such units.

Individual Differences

Three major differences were allowed for in the development of our materials.

1. Stage of Intellectual Development

Three stages in the intellectual development of junior secondary students were identified, and materials were developed to suit the students at each of these stages of development.

Stage I materials are for those students at a concrete stage in their intellectual development. Units for students at this stage explore the environment through direct concrete experience, so that there is a direct and immediate relationship between the experience and the idea being developed. Student activity in real situations provides the major source of motivation and experience.

Stage II materials are for those students who are in a transitory stage in their intellectual development. Units for this stage are largely activity-based, but provide students with an opportunity to explore more formal or abstract modes of thinking. Students at this stage are encouraged to explore situations that involve more formal or logical mental operations from a sound base of concrete experience.

Stage III materials are for those students who have reached the formal stage in their intellectual development. These students can manipulate ideas mentally without recourse to concrete experience, and can handle more abstract thought. Activity in terms of real concrete examples is less important at this stage, and the types of activity offered in these units changes. Second-hand data may be used, and extrapolation from one situation to another without recourse to the physical reality of the second situation is possible.

The Project has developed 17 Stage I units, 14 Stage II units, and 9 Stage III units.

2. Reading Level

Believing that more disadvantage accrues if the reading level of the

materials is too difficult than if it is too easy, ASEP has written the materials at least one grade level below that for which the materials are to be used, in an attempt to provide for at least some of the less able readers.

3. Interests of Children and Rates of Working

In ASEP, we are firmly of the opinion that all children in a given class need not be doing the same things at the same time. If this idea is accepted, then many possibilities open up for the teacher and his students. Also, it provides a real challenge to the developers of the materials to cater for several possibilities in the one set of materials.

The Project has decided on a unit design intended to permit the fostering of individual student interests and to allow them to work at different rates. Most units have a core which will occupy up to about a quarter of the total time to be spent on the unit. All students are expected to attain a minimum level of competence on this core material, hence students will spend varying times working on it.

The remainder of the time on the unit is spent working on a number of the options offered. There may be as many as twelve of these options, of which the average student may do only three or four. The students are expected to pursue their own interests in these options. This gives an opportunity for a wide base of knowledge within a class on a particular topic, and the best students in the class will not necessarily know everything. It is hoped that the system will produce interesting possibilities in group discussion.

Teaching Approach

During the development of a unit, two particular teaching approaches were kept in mind. The first of these relates to learning through inquiry and the second derives from an interpretation of Piagetian theory.

The inquiry approach required that students be actively involved in learning, seeking answers to questions, using procedures that are appropriate to scientific investigation. The extent to which the discovery is guided and findings predetermined depends on the level at which the child is operating and the need to use the findings in following activities. In general, guided discovery tends to be used in the core of a unit, with open-ended activities appearing in the options.

Several principles relating to learning were derived from Piagetian theory. Consistent with these, the material is written in such a way that the major source of learning is the activity of the child, with children being offered a certain amount of control over their own learning. New ideas and knowledge are presented at the level of the child's present thinking and language, use being made of moderately novel situations.

Evaluation and Classroom Trials

After acceptance of the topic each unit was developed by a staff member working in conjunction with a content specialist and a research officer. The unit was then produced and printed ready for classroom trial. Two classroom trials were planned for each unit.

The purpose of the first classroom trial was to test the validity of the materials in the actual teaching situation. Schools were selected close to ASEP

headquarters so that continuing contact could be maintained between trials teachers and Project staff.

During the first trial, close attention was paid to errors, inconsistencies, and inadequacies in the materials as revealed in the classroom. During this period the materials were also subjected to close scrutiny by scientists and science educators.

Suitable instruments, eg questionnaires and checklists, were developed to facilitate the evaluation of the trial materials. A major source of this feedback came from the face-to-face contact between trials teachers, students and Project staff.

Evidence gathered from the first trials was used as a basis for revision of the materials for a second, National trial.

The over-all purpose of the National trials was to test the validity of the materials and to disseminate information on ASEP. These trials provided a nucleus of teachers experienced in ASEP philosophy and the use of ASEP materials. Through this experience the States have been able to implement a National Teacher Education program for the use of published ASEP materials.

ASEP has not provided "the answer" to the problems of junior secondary science but it has offered some possibilities which teachers may wish to use to help them in their teaching.

ASEP has achieved a number of purposes besides those formally stated. It provided a group of people with experience in the development of curriculum materials and the evaluation of classroom instruction in a Project wider in scope than anything seen previously on the Australian education scene. It provided a focus for science teachers and science teaching outside traditional school, school systems or State concerns, and which was truly national in perspective.

It fostered interstate cooperation and the exchange of ideas on curriculum matters at a national level. Finally, the Project provided a well-documented story of an experiment in curriculum development which will be valuable for future planning in education. Prior to ASEP, no precedents existed in Australia for such a Project, and the United States and British models for curriculum development differ in many respects from that developed by ASEP. It will be for the science teachers of Australia to decide whether the experiment was successful.

(This article was contributed by Mr L Dale, Deputy Director, ASEP.)

24. BOMBAY SCIENCE IMPROVEMENT PROJECT

For the last six years the Education Department of the Municipal Corporation of Greater Bombay has given a great deal of thought to the teaching of science and mathematics in its primary schools. It has realised that the completely sequential and formal syllabus introduced by the State of Maharastra in 1967 does not fully cater to the needs of an urban society like Bombay. It has further realised that with the fast increasing scientific and technical knowledge in the world today, it is essential that nations wishing to keep in the forefront of progress must continually research into and upgrade their programmes of science and mathematics teaching. India was committed to a programme of scientific advancement by Prime Minister Nehru and this has been further proclaimed by the present Prime Minister Mrs Indira Gandhi. Hence in order to aid national development and endeavour, to improve the level of living through increasing the competency of the teachers, and to prepare its students for a modern scientific society, the Education Department of the Municipal Corporation of Greater Bombay through its

dynamic education officer Dr (Mrs) Madhuri Shah has endeavoured to introduce a planned, phased programme of new ideas into its educational system.

The entire programme envisages the preparation of an enriched curriculum in science consisting of fully illustrated Teachers' Guides, Children's Workbooks, kits of materials with enough equipment for the children "to do science not watch it", in the age range 5 to 11/12 years. Compulsory education in India is in theory up to 11 years of age and a major problem is to see that more than a minority of children attend even primary school. Classes are large in number of pupils whilst being small in area. At present in Bombay there are over 1100 municipal primary schools catering for 600,000 children, teaching in 10 languages. It is very common to find within a school building five or even six schools each with its own autonomy and no interaction between the schools because of a language barrier. The predominant language is Marathi, followed by Urdu and Gujarati. Thus one of the major problems in the production of any new materials is translation. Initially all new materials were produced in English, now they are produced in the mother tongue and then translated. So far materials have been produced in only five languages, the above three plus Hindi and English. In order to cut down production costs of books a bilingual approach has been tried in standard II by combining Hindi/English and Marathi/Gujarati whilst Urdu must of necessity remain on its own.

The overall objectives of the project can be stated as follows:

1. To undertake the study of the new science syllabus published by the State of Maharastra, with the view to reshuffling its contents and enriching it to suit a completely urban area like Bombay.

2. To prepare teachers' guides and children's workbooks in science for standards I to VII, all fully illustrated.

3. Preparation of science kit materials for all the classes containing all the necessary materials to enable children to perform experiments individually or in small groups.

4. To try out materials produced in actual classrooms so as to judge their validity, suitability and feasibility.

5. To develop an attitude in both teachers and pupils towards accepting the spirit of scientific inquiry or discovery.

6. To enrich the subject matter and knowledge of the teachers in science through direct experience.

7. To help teachers in preparing teaching aids and models.

8. To help the teachers in adopting the latest methods in evaluating their pupils' work.

9. To train the project participants in preparing and using audio-visual aids.

How far have these objectives been achieved and adhered to?

Teachers' guides have been produced and introduced for Standards I to VI in the major languages and it is hoped that standard VII will be completed in August 1973. The concept of children's books has been rethought and from standard III workcards will be introduced. This cuts down the cost considerably.

In the first phase, which was the production of materials for standards I to

IV the State syllabus was adhered to, but it was enriched and as far as possible the work was carried out by the pupils. However a preliminary evaluation of these materials after 12 months showed a lack of understanding by the children of many of the concepts listed in the syllabus. This led to a complete rewrite of the standard I to IV syllabus and the production of a new edition will be completed by June 1973. Further and very much more important, it has led to the production of a new type of syllabus based upon a combined or undifferentiated approach to science teaching in standards V to VII. India is such a vast and exciting nation that there is plenty of room for experimentation in many forms of science teaching, not just one. The problems of the rural schools are vastly different from those of a large urban area like Bombay. However, the new materials for standards V to VII have borne in mind that many of the children in the municipal schools will continue in a very formal type of secondary education in standards VII to X.

In each phase, science kits have been produced, based on local indigenous materials readily available in the markets and whatever waste materials are available. Things that one takes for granted in the Western countries, like old tins, jam jars, boxes, are not readily available since they are sold for re-use. All these items have to be purchased from the junk-yards. The total cost of the kit materials is Rs 200/- per school, ie approximately £10. Due to the large strain on available finance each kit has to be used for standards I to IV with one or two additional items provided for standards III and IV. Many activities which were known to work very well in the West were found not to work here. For example many experiments requiring a source of heat had to be modified due to the unavailability of gas and the requirement of a government permit to obtain even a small quantity of methylated spirit.

A major part of the programme has consisted of the training of teachers to implement the new materials. In 1971, 120 teachers were trained from the five major language groups to try out the new material in standards I and II. In 1972 a further 250 teachers were trained for standards I and II plus 40 teachers for the new material produced for standards III and IV. Each training session consists of a three week intensive workshop where an attempt is made to reorientate the teachers' basic ideas from a rote approach to teaching to an activity centred one, coupled with actual experiences in the use of the materials. This first workshop is immediately followed by a one week workshop where the teachers are expected to make simple classroom aids and use tools (probably for the first time in their lives). Finally a follow-up workshop is held half-way through the year, where problems can be discussed and ideas exchanged. All the teachers meet once a month in their language groups for about two hours to sort out difficulties. Probably the most difficult part of the whole programme is changing the attitude of the teachers (and of course the headteacher) towards classroom teaching. This is not difficult to understand when one realises that for thousands of years learning in India has been steeped in an aural tradition and obviously this will not be changed overnight.

Finally in February/March 1973 a group of 20 teachers have been trained to try out the new materials for standards V and VI. This year a further 400 teachers will be given training in the materials for standards I and IV.

Perhaps then for Bombay there is a touch of brightness amongst the clouds. By June 1973 nearly 1000 teachers will have been given what can only be called a minimum training in a new approach to teaching; BUT there are still 14,000 to go One hundred schools are working on a newly drafted syllabus and using an activity approach for the first time, BUT there are still over one thousand which are using the traditional methods.

However a beginning has been made.

(This article was contributed by John H Brookes, ACTS Officer, Bombay.)

25. IRAN - Development of mathematics and science education

25.1 The Educational System: This is presently moving from a 6 (primary) + 6 (secondary) pattern to a 5 (primary) + 3 (guidance and counselling cycle) + 4 (secondary/vocational cycle). At the moment 85% of the 12th graders study science. There are 4 streams in the last few years of secondary schooling which are natural science, mathematics, literature and human sciences, and technical and vocational. 15% only take the latter two options. In the Ministry of Education amongst others, there are Departments of Curriculum and Research, Textbooks, Teacher-Training, Examinations, Primary Education, Guidance Education (second cycle), and Secondary Education (third cycle). All have been planning and executive departments in the past (centralised control), and are now adjusting to the role of planning, for example in teacher-training or in guidance education, etc. The system is becoming decentralised and based more on the provinces. At present, as in the past, textbooks and curriculum are closely controlled centrally. For each year's school a student's book and a teacher's guide in all subjects are prescribed. This means that uniformity throughout Iran is a feature of the educational system. The curriculum and research department's responsibility is to determine the aims of the course and the syllabus of each year of the schooling and to divide these into separate year intervals. The textbook department has the responsibility of writing books keeping to the guidelines laid down by the curriculum department and then to publish and distribute the books nationally. These books are heavily subsidised and cost nothing in the first cycle (age range 7-11) and a nominal amount for the books of the higher cycles. The curriculum department also has responsibility for evaluating these courses and thus to continually improve what is taught.

25.2 Curriculum changes: As the change from the 6 + 6 system to the 5 + 3 + 4 system is taking place, complete curriculum changes are taking place. At the moment the system has reached the second year of the second cycle. All the books for these years have been rewritten and the syllabus changes for the last 4 years of secondary schooling is now being worked out. The books for the 3 years of the guidance cycle are translations and adaptations of the 3 books from the United States. A form of combined science is done in the first two cycles 5 + 3 and separate subjects after. Mathematics in the first two cycles is taught as mathematics but the course for the last 4 years of schooling is still in preparation and uncertainty still exists regarding whether it is going to be combined or separated into more traditional subjects. Modern mathematics will be included.

25.3 Pre- and In-service Training of Teachers There are about 60 normal colleges training about 3,000 first cycle teachers per year. The students at these colleges are mainly aged 17-19 and have had at least 9 years of schooling. Guidance and counselling colleges train teachers for the second cycle of schooling. There are 15 such colleges training 3,000 teachers per year. All students on entering the 2 year course must have completed 12 years of schooling. Much retraining of teachers has been needed and this has been done by evening classes and summer courses. Summer courses have also been held and are continuing to be held to retrain teachers for the third cycle of schooling. In addition there have been summer seminars since 1970 for the lecturers at the normal colleges and guidance colleges. These are held at the universities.

26. SWAZILAND

A national science teaching panel was set up in the Kingdom of Swaziland about 18 months ago under the chairmanship of the Senior Inspector (Science) and

has been responsible for much recent activity in science education. The panel includes, besides its chairman, representatives from the UBLS School of Education and the Teacher Training Colleges, as well as a number of practising science teachers. It meets approximately once a month and advises the Ministry of Education on all matters pertaining to science education in the kingdom.

Up to now the panel's activities have been almost exclusively in the field of secondary education. Shortly after its formation, and owing to dissatisfaction with the existing syllabus, a workshop was held to evaluate six Junior Secondary Science courses with a view to selecting one for adaptation to local needs. Following a similar regional workshop at Roma (Lesotho), both Swaziland and Lesotho decided to adopt the West Indian Science Curriculum Innovation Project (WISCIP) materials as a basis and to modify them for use in the respective countries. A series of preliminary trials of the first year materials was held in Swaziland during 1972 and constituted the first stage of what is now known locally as SWISP (the Swaziland Integrated Science Project). The coordination and day-to-day running of the project is in the hands of the British Council ACTS Officer, Swaziland, and a pilot scheme (involving the use of modified materials in ten schools) started in January of this year with the support of the Ministry and financial aid from ODA. Simultaneously with the pilot work on the first year materials there will be preliminary testing of the second year work and it is hoped to introduce the new curriculum into the first year of all secondary schools in 1974.

The SWISP course is a three year integrated science course firmly based on the WISCIP materials which in turn lean heavily on the Scottish Integrated Science Syllabus. Indeed, pupils in the pilot schools are using the Scottish books "Science for the 70s" as a text and the project materials take the form of a very detailed lesson-by-lesson (or rather activity-by-activity) guide for teachers. The conduct of the project has been organised so as to maximise the involvement of local teachers in the rewriting and modification of materials and it is hoped that most secondary schools in the country will have been involved in either pre-pilot or pilot work before the completion of the project. A novel feature of the course (still in the planning stage as yet) is the intention to provide for a science reference programme. In this pupils will be given a series of regular assignments which will require them to make use of appropriate general interest books on scientific and technological subjects and may, hopefully, lead to an improved background knowledge outside the confines of the syllabus itself.

In addition to SWISP and the associated in-service (and pre-service) courses a number of short courses for secondary teachers are organised each year by the Swaziland Science Teachers' Association. The Association also runs an annual Science Fair and in 1972 this attracted over 100 entries for the first time (though it was disappointing to note that only 16 out of the 54 secondary schools had entries).

In the primary field there has been rather less activity but 40 schools have been involved in a pilot scheme to encourage more activity based science teaching. The scheme was initiated by the inspectorate and ten schools entered pupils for a practical alternative paper in the 1972 Swaziland Primary Certificate Examination. The practical approach to science teaching has been supported, in recent years, by an annual TVC staffed by tutors from UK of whom one has always been concerned with science. The science panel has now set up a sub-committee to handle primary science matters and, in particular, to make recommendations regarding the curriculum. Hopefully, the day is approaching when we will see the present unsuitable content laden syllabus replaced by something more appropriate to the pupils' needs at this level.

(This article was contributed by Mr D Slimming, ACTS Officer, William Pitcher Teachers' College, Swaziland.)

27. UNITED STATES OF AMERICA

The Center for Unified Science Education (CUSE) at the Ohio State University has recently produced the first of what is intended to be a regular newsletter on activities in unified science education. This is called Prism II. The Center for Unified Science Education is dedicated to:

27.1 Developing and disseminating the concept of unified science education; and

27.2 Facilitating the development of high quality unified science programmes in individual schools throughout the United States.

The Center is located at Ohio State University, Colombus and detailed information on the activities of the Center and on the publication of the newsletter can be obtained from Dr V Showalter, Director, Center for Unified Science Education, Ohio State University, 1460 West Lane Avenue, Ohio 43221, USA.